IS 4071 (1986): Master Gears [PGD 31: Bolts, Nuts and Fasteners Accessories]

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Indian Standard

(Reaffirmed 2005)

SPECIFICATION FOR MASTER GEARS

(First Revision)

1. Scope — Covers the requirements for master gears in the range of 1 to 12 mm normal module and with a normal pressure angle of 20°. Gears complying with the requirements of IS : 2535-1978 'Basic rack and modules of cylindrical gears for general engineering and heavy engineering (*second revision*)' and IS : 3681-1966 'General plan for spur and helical gears' shall be checked by these master gears.

1.1 In addition to data for standard master gears, guidance is also given on the following:

a) Calculation of the centre distance of a master gear (spur) in tight mesh with a product gear — *see* Appendix A.

b) Determination of the minimum diameter on a production gear that will be checked by a given master gear — *see* Appendix B.

c) Special master gear — *see* Appendix C.

2. Definitions and Notations — For the purpose of this standard, definitions and notations given in IS : 2458 (Part 1)-1965 'Glossary of terms for toothed gearing: Part 1 Cylindrical gears', IS : 2467-1963 'Notation for toothed gearing' and IS : 3681-1966 are applicable.

3. Grades — Three grades of master gears designated Grade 2, Grade 3 and Grade 4 are specified which shall comply with the requirements of Grade 2, Grade 3 and Grade 4 according to IS : 3681-1966 except for tolerances otherwise specified in this standard.

4. Dimensions — A range of standard master gears based on six gear blank sizes has been established.

4.1 *Gear Blanks*

4.1.1 Master gear blanks shall have the dimensions as given in Table 1 read with Fig. 1.

4.1.2 Each size of master gear blank may be made either without test flange (Type A) or with test flange (Type B).

4.2 *Gears* — Master gears shall have the dimensions as given in Table 2 or Table 3.

5. Tolerances — Master gears shall comply with the tolerances defined for the appropriate grades in IS : 3681-1966 [except for tolerances otherwise specified in this standard (*see* Table 1)].

6. Finish — All sharp edges shall be removed from the test flange, periphery and the ends of teeth before use.

7. Material — Master gears shall be manufactured from a high-quality stable tool steel such as T105Cr1 or T105Cr1Mn60 conforming to IS : 1570-1961 'Schedules for wrought steels for general engineering purposes'.

Gears Sectional Committee, EDC 59 [Ref : Doc : EDC 59 (4171)]

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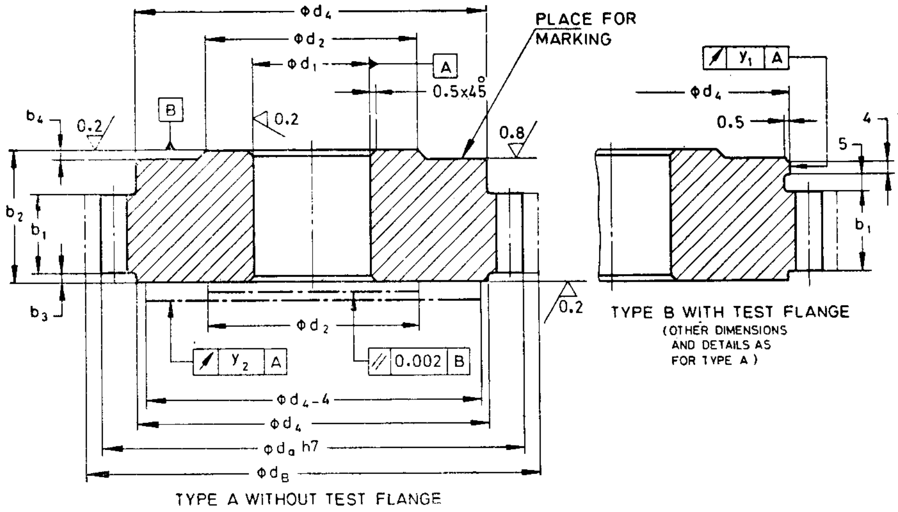
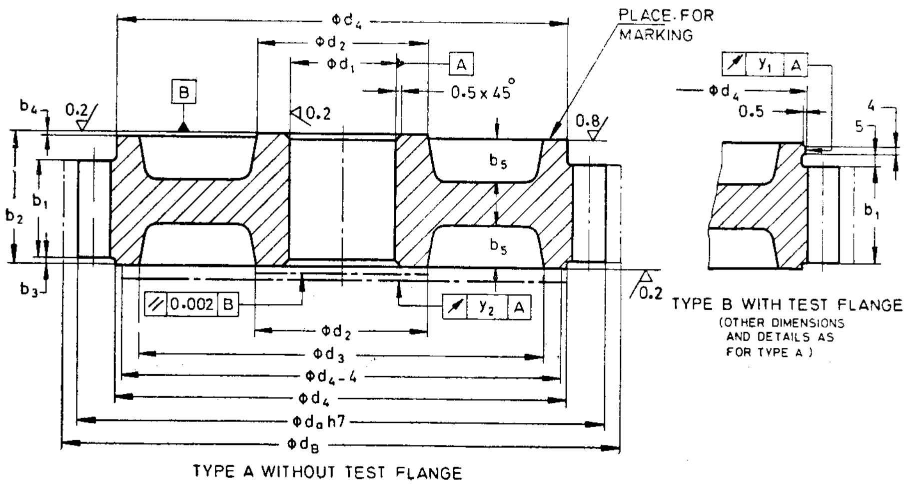


1A Master Gear Blank Sizes 1 to 3
(Normal Module m_n 1 to 3·55 mm)



1B Master Gear Blank, Sizes 4 to 6
(Normal Module m_n over 3·55 to 12 mm)

Note — Tip corners deburred, other corners broken.

All dimensions in millimetres.

FIG. 1 DIMENSIONS FOR MASTER GEAR BLANKS

8. Hardness

8.1 Master gears shall be suitably heat treated such that the tooth surfaces shall have a minimum hardness of 62 *HRC* [*see* IS : 1586-1968 'Methods for rockwell hardness test (B and C scales) for steel (*first revision*)'].

8.2 Master gears shall be properly treated to relieve internal stresses.

TABLE 1 DIMENSIONS OF MASTER GEAR BLANKS

(*Clauses* 4.1.1, 5 *and* 9.2; and Fig. 1)

All dimensions in millimetres.

Normal Module m_n: Preferred	Normal Module m_n: Second choice	Master gear blank size number	*d_B	d_1: Nominal size	d_1: †Tolerance (IT 4)	d_1: ‡Circularity (0·25 IT 4)	d_1: ‡Straightness of generator (0·25 IT 4)	d_2	d_3	§d_4	b_1: Nominal	b_1: Tolerance	b_2	b_3	b_4	b_5	y_1: Grade 2	y_1: Grade 3	y_1: Grade 4	‖y_2: Grade 2	‖y_2: Grade 3	‖y_2: Grade 4	Permissible Width Reduction on Each Side of the Tooth Flank
1		1	50	22	+0·006	0·001 5	0·001 5	—	—	d_f-5	12·5	0 −0·18	30	1	—	—	2	3	3	2	2	3	1·5
1·25 1·5 2	1·75	2	85	32	0 +0·007	0·002	0·002	50	—	d_f-5	17	0 −0·2	33	1	0·5	—	2	3	3	2	2	3	2
2·5 3	2·25 2·75 3·5	3	125	32	+0·007 0	0·002	0·002	60	—	d_f-5	23	0 −0·22	36	2	1	—	2	3	3	2	2	4	2·5
4 5	4·5 5·5	4	170	45	+0·007	0·002	0·002	70	d_4-16	d_f-5	30	0 −0·25	43	2	1	12	2	3	3	2	3	4	3
6 8	(6·5) 7	5	224	45	+0·007	0·002	0·002	70	d_4-20	d_f-5	42·5	0 −0·25	56·5	3	1	18	2	3	4	2	3	5	3·5
10 12	9 11	6	280	60	+0·008 0	0·002	0·002	90	d_4-24	d_f-5	60	0 −0·3	74	3	1	28	2	4	4	2	3	5	4

*The diameter d_B is simply a basis for calculating numbers of teeth as explained in the explanatory note. The tip circle diameter d_a of the master gear can differ appreciably from d_B.

†Permissible variation of the cylinder generatrix from the straight line in the axial longitudinal section between any two transverse sections.

‡Does not apply to the two ends of the hub over a 4 mm length of bore on each side. Over this distance, the bore diameter may be larger but not smaller.

§$d_f = d + 2\,m_n\,(x - 1{\cdot}25)$ where $d = z.m_t$, and $m_t = m_n/\cos\beta$.

‖Regardless of the way in which the master gear used (either fixed or rotatable on the arbor), y_2 is tested on a fixed arbor. Prior to measurement of y_2, the concentricity of the receiving arbor must be checked on either side of the master gear. The concentricity tolerance for arbor is 0·002 m_n.

TABLE 2 STANDARD SPUR MASTER GEARS

(*Clause* 4.2)

Normal Module m_n Preferred	Normal Module m_n Second choice	z	x	Master Gear Blank Size Number
1		48	—	1
1·25		64	—	
1·5		54	—	2
	1·75	46	—	
2		40	—	
	2·25	52	—	
2·5		48	—	
	2·75	42	—	3
3		38	—	
	3·5	32	—	
4		40	—	
	4·5	34	0·03	4
5		30	0·15	
	5·5	28	0·21	
6		34	0·03	
	(6·5)	32	0·09	5
	7	28	0·21	
8		24	0·33	
	9	28	0·21	
10		24	0·33	6
	11	22	0·39	
12		20	0·45	

TABLE 3 STANDARD HELICAL MASTER GEARS

(*Clause* 4.2)

Normal Module m_n Preferred	Normal Module m_n Second Choice	Helix Angle β in Degrees Over	Helix Angle β in Degrees Up to	z	x	Master Gear Blank Size Number
1		—	16·5	46	—	1
		16·5	23·5	44	—	
		23·5	28·5	42	—	
		28·5	33·5	40	—	
		33·5	37·5	38	—	
		37·5	41	36	—	
		41	44·5	34	—	
		44·5	45	32	—	
1·25		—	14	64	—	2
		14	21·5	60	—	
		24·5	28·5	58	—	
		28·5	31·5	56	—	
		31·5	35	54	—	
		35	38	52	—	
		38	40·5	50	—	
		40·5	43	48	—	
		43	45	46	—	
1·5		—	85	54	—	2
		85	17·5	52	—	
		17·5	23·5	50	—	
		23·5	28·5	48	—	
		28·5	32·5	46	—	
		32·5	36	44	—	
		36	39·5	42	—	
		39·5	42·5	40	—	
		42·5	45	38	—	
	1·75	—	8·5	46	—	2
		8·5	19	44	—	
		19	25·5	42	—	
		25·5	80·5	40	—	
		30·5	35	38	—	
		35	39	36	—	
		39	43	34	—	
		43	45	32	—	
2		—	9	40	—	2
		9	20	38	—	
		20	27	36	—	
		27	32·5	34	—	
		32·5	37·5	32	—	
		37·5	42	30	—	
		42	45	28	—	
	2·25	—	13·5	52	—	3
		13·5	21	50	—	
		21	26	48	—	
		26	30·5	46	—	
		30·5	34·5	44	—	
		34·5	38	42	—	
		38	41·5	40	—	
		41·5	44·5	38	—	
		44·5	45	36	—	

(*Continued*)

TABLE 3 STANDARD HELICAL MASTER GEARS — *Contd*

Normal Module m_n Preferred	Normal Module m_n Second Choice	Helix Angle β in Degrees Over	Helix Angle β in Degrees Up to	z	x	Master Gear Blank Size Number
2·5		—	16·5	46	—	3
		16·5	23·5	44	—	
		23·5	28·5	42	—	
		28·5	33·5	40	—	
		33·5	37·5	38	—	
		37·5	41	36	—	
		41	44·5	34	—	
		44·5	45	32	—	
	2·75	—	14·5	42	—	3
		14.5	23	40	—	
		23	29	38	—	
		29	34	36	—	
		34	38·5	34	—	
		38·5	42·5	32	—	
		42·5	45	30	—	
3		—	16·5	38	—	3
		16·5	24·5	36	—	
		24·5	31	34	—	
		31	36	32	—	
		36	40·5	30	—	
		40·5	45	28	—	
	3·5	—	18	32	—	3
		18	27	30	—	
		27	33·5	28	—	
		33·5	39·5	26	—	
		39·5	44·5	24	—	
		44·5	45	22	—	
4		—	9	40	—	4
		9	20	38	—	
		20	27	36	—	
		27	32·5	34	—	
		32·5	37·5	32	—	
		37·5	42	30	—	
		42	45	28	—	
	4·5	—	17·5	34	0·03	4
		17·5	26	32		
		26	32·5	30		
		32·5	38	28		
		38	43	26		
		43	45	24		
5		—	18·5	30	0·15	4
		18·5	27·5	28		
		27·5	34·5	26		
		34·5	40·5	24		
		40·5	45	22		
	5·5	—	10·5	28	0·21	4
		10·5	24	26		
		24	32·5	24		
		32·5	39	22		
		39	45	20		
6		—	15	34	0·03	5
		15	24·5	32		
		24·5	31·5	30		
		31·5	37	28		
		37	42·5	26		
		42·5	45	24		
	(6·5)	—	7·5	32	0·09	5
		7·5	21·5	30		
		21·5	29·5	28		
		29·5	36	26		
		36	41·5	24		
		41·5	45	22		
	7	—	18·5	28	0·21	5
		18·5	28	26		
		28	35·5	24		
		35·5	41·5	22		
		41·5	45	20		
8		—	18·5	24	0·33	5
		18·5	29·5	22		
		29·5	37·5	20		
		37·5	44·5	18		
		44·5	45	16		
	9	—	12·5	28	0·21	6
		12·5	25	26		
		25	33	24		
		33	39.5	22		
		39·5	45	20		
10		—	18·5	24	0·33	6
		18·5	29·5	22		
		29·5	37·5	20		
		37·5	44·5	18		
		44·5	45	16		
	11	—	14	22	0·39	6
		14	28	20		
		28	37·5	18		
		37·5	45	16		
12		—	11·5	20	0·45	6
		11·5	28	18		
		28	38·5	16		
		38·5	45	14		

(*Continued*)

9. Mounting of Master Gears for Their Acceptance Testing

9.1 Unless otherwise agreed upon, master gears of Grade 2 shall be supplied mounted on arbors. The position of the master gear on the arbor shall be marked by the manufacturer and the gear shall not be moved until acceptance tests have been completed. The guarantee that the tolerances of this standard have been complied with, is subject to these conditions. The runout of the arbor on each side of the master gear shall be stated when arbor-mounted gears are supplied.

9.2 Even when the master gear has a test flange, the arbor shall be checked for concentric running on either side of the master gear. The concentricity variation measured on the test flange must not exceed the values stated in Table 1.

9.3 If, as a result of special agreement, master gears of Grade 2 are supplied without arbor, their acceptance likewise shall be subject to special agreement between the purchaser and the manufacturer.

9.4 Master gears of Grade 3 and Grade 4 are supplied without arbor unless otherwise agreed upon between the purchaser and the manufacturer.

10. Inspection

10.1 Appropriate methods of inspection and measurement shall be used for checking various parameters of master gear blanks.

10.2 Various parameters of gear teeth shall be inspected according to IS : 7504-1974 'Methods of inspection of spur and helical gear'. Checking of the profile, tooth spacing, position error and tooth thickness is most important to ascertain the quality of a master gear. Tooth thickness must be measured by some direct fundamental method; measuring over pins is the preferred method.

11. Recalibration — It is recommended that master gears are recalibrated at periodic intervals depending upon usage or at an interval of not more than two years.

12. Designation — The master gears shall be designated by the name, type, normal module, normal pressure angle, helix angle, hand of helix, grade and number of this standard.

12.1 A master gear without test flange (Type A) with normal module $m_n = 5$ mm, normal pressure angle $\alpha n = 20°$ and corresponding to Grade 2 of this standard shall be designated as:

Master Gear A × 5 × 20 × 0 × R 2 — IS : 4071

12.2 A master gear with test flange (Type B) with normal module $m_n = 5$ mm, normal pressure angle $\alpha_n = 20°$ helix angle $\beta = 30°$, left handed (L) and corresponding to Grade 2 of this standard shall be designated as:

Master Gear B × 5 × 20 × 30 L × 2 — IS : 4071

13. Marking

13.1 Each master gear shall be marked with the following information where applicable; for convenience, symbols may be used where desired:

a) normal module m_n

b) normal pressure angle at reference circle diameter α_n

c) number of teeth z

d) helix angle β

e) hand of helix R or L

f) position of datum tooth

g) grade

h) measured normal tooth thickness at reference circle diameter s

j) number of this standard IS : 4071

k) manufacturer's name or trademark and product identification number (including year of manufacture)

13.2 Fig. 2 shows a typical example of marking of a master gear.

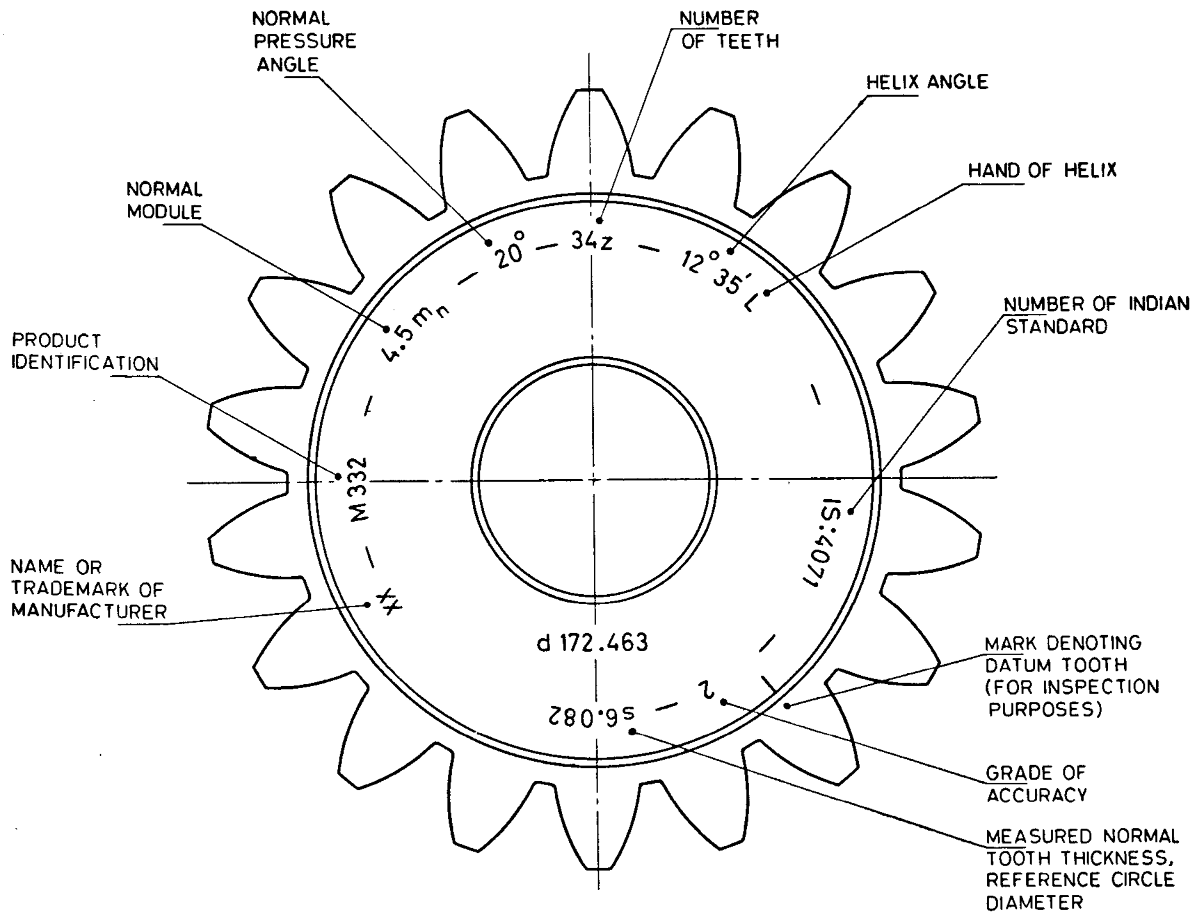


FIG. 2 TYPICAL EXAMPLE OF MARKING OF MASTER GEAR

14. Ordering Instructions — It is recommended that the purchaser should state the following on his order:

a) normal module
b) normal pressure angle
c) helix angle
d) hand of helix
e) grade
f) type
g) number of this standard IS : 4071

15. Packing, Storing and Handling — Master gears shall be applied with suitable anti-corrosive coatings to protect them from corrosion and shall be suitably packed to prevent damage during transit and storage. In use, they are to be handled as carefully as other measuring tools.

16. Application of Master Gears

16.1 Master gears of Grade 2 are used for verifying gear testers and for checking gears primarily of Grades 4 and 5 according to IS : 3681-1966, though they may also be used for checking gears of Grades 8 to 12 according to IS : 3681-1966.

16.2 Master gears of Grade 3 are used for checking gears primarily of Grades 6 and 7 according to IS : 3681-1966, though they may also be used for checking gears of Grades 8 to 12 according to IS : 3681-1966.

16.3 Master gears of Grade 4 are used for checking gears of Grades 8 to 12 according to IS : 3681-1966.

16.4 Summary of the application of master gears of Grades 2, 3 and 4 is given in table below:

Grade of Master Gear	Primary Application	Secondary Application
Grade 2	1) Verification of gear tester 2) Checking gears of Grades 4 and 5 according to IS : 3681-1966	Checking gears of Grades 6 to 12 according to IS : 3681-1966
Grade 3	Checking gears of Grades 6 and 7 according to IS : 3681-1966	Checking gears of Grades 8 to 12 according to IS : 3681-1966
Grade 4	Checking gears of Grades 8 to 12 according to IS : 3681-1966	—

APPENDIX A

(*Clause* 1.1)

CALCULATION OF THE CENTRE DISTANCE OF A MASTER GEAR (SPUR) IN TIGHT MESH WITH A PRODUCT GEAR

$$a_w = \left(\frac{d + d_1}{2}\right)\left(\frac{\cos \alpha_t}{\cos \alpha_{tw}}\right)$$

α_{tw} is derived from the equation $I_{nv}\, \alpha_{tw} = \dfrac{z_1 (s_t + s_{t1}) - \pi d_1}{d_1 (z + z_1)} + I_{nv}\, \alpha_t$

where

z = Number of teeth of master gear

z_1 = Number of teeth of product gear

s_t = Transverse arc thickness of tooth at diameter d of master gear

s_{t1} = Transverse arc thickness of tooth at diameter d_1 of product gear

d = Reference circle diameter of master gear

d_1 = Reference circle diameter of product gear

α_t = Pressure angle at reference circle diameter of both gears

α_{tw} = Working pressure angle when master gear in tight mesh with product gear

a_w = Centre distance when master gear is in tight mesh with product gear

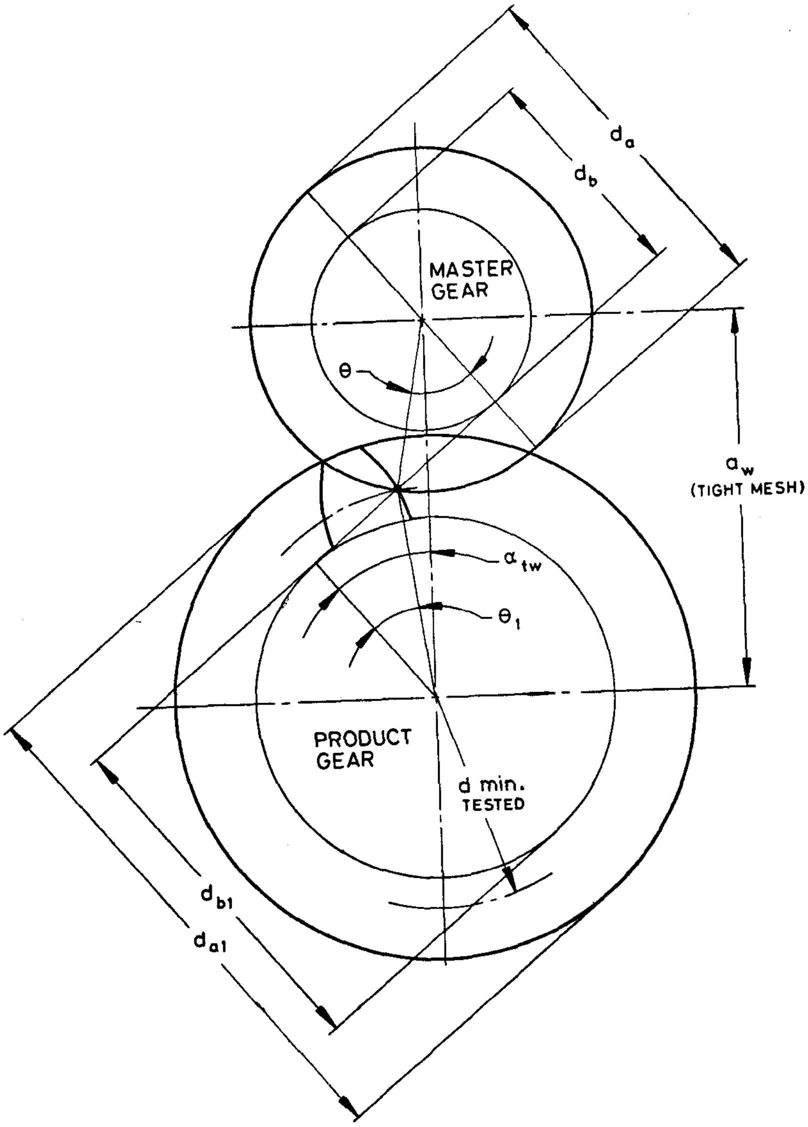
I_{nv} = Involute function

Note — The suffix '1' is here used to indicate ' of product gear '; no suffix is used for master gear notation. Mating product gear (examples of which are not given here) should be indicated by the suffix ' 2 '.

APPENDIX B

(*Clause* 1.1)

DETERMINATION OF MINIMUM DIAMETER ON A PRODUCTION GEAR THAT WILL BE CHECKED BY A GIVEN MASTER GEAR



When testing a product gear with a master gear, the involute properties are checked from the tooth tip to a point whose position can be calculated by use of the following expressions:

$d_b = d \cos \alpha_t$

$\cos \theta = \dfrac{d_b}{d_a}$

$\tan \theta_1 = \dfrac{(2a_w \sin \alpha_{tw}) - (d_b \tan \theta)}{d_1 \cos \alpha_t}$

where a_w and α_{tw} are as given in Appendix A.

The minimum diameter tested is given by one of the following:

$$\frac{d_{b1}}{\cos \theta_1} \qquad \text{...... (1)}$$

or

$$\sqrt{\left(2a_w \sin \alpha_{tw} - \sqrt{(d_a)^2 - (d_b)^2}\right)^2 + (d_{b1})^2} \qquad \text{...... (2)}$$

APPENDIX C

(*Clause* 1.1)

SPECIAL MASTER GEARS

Master gears with normal modules differing from those listed in Table 2 and Table 3 (which are according to IS : 2535-1978) are reckoned as special master gears.

Also reckoned as special master gears are those which do not comply fully with any of the provisions of this standard, namely, profile displacement, bore diameter, number of teeth, hub width, face width, hub diameter, any other diameter or width, tooth thickness allowance, etc.

The calculation procedure for the maximum number of teeth and the profile displacement factor for modules differing from IS : 2535-1978 is same as explained at 3 of the Explanatory Note.

The number of teeth for master gears with addendum differing from IS : 2535-1978 are determined according to the same procedure as explained at 3 of the Explanatory Note. There are thus extreme cases in which d_a is larger than d_B.

In case of special master gears which do not comply with this standard in all respects, the following points should be observed in order of importance.

Profile displacements differing from this standara should only be adopted if checking of the active profile is otherwise impossible. In such cases the number of teeth and the profile displacement should be chosen so as to allow the gear blank provided for the module range concerned or failing this one of the other standardized gear blanks to be used.

Bore diameter d_1 and the tolerance on this should in all cases be selected in accordance with this note.

If a smaller or larger number of teeth is needed the size of gear chosen should be the one requiring the smallest number of departures from this standard. At the same time, the order of importance expressed in these recommendations should also be observed. When the number of teeth z differs from this standard, it should preferably be made even-numbered and from $z \geqslant 60$ divisible by 4 without remainder.

Hub width b_2 should always be selected according to this standard. Whenever the face width b_1 is modified, care must be taken to ensure that the teeth have a clearance b_3 on both sides in accordance with Table 1 from the outer faces of the master gear.

The hub diameter d_2 should only be changed if the bore diameter d_1 is increased so that $d_2 \approx 1{\cdot}6\, d_1$ continues to hold good.

If it is necessary to depart from the diameter d_3 and d_4 given in Table 1 for the gear blanks, i. e., selecting intermediate sizes, d_4 should be atleast 4 mm smaller than the root circle diameter d_f. The diameter d_3 should be chosen so that $d_4 - d_3$ is atleast 15 mm so as to maintain adequate space for the inscription.

Widths b_3, b_4 and b_5 should not be altered because altering them cannot improve the operation of the master gear.

The tooth thickness tolerance T_s of a master gear must always correspond to the prescribed grade of accuracy. It can, however, he agreed that the tolerance zone may also lie outside the limits $A_{se} = + T_s$ and $A_{si} = - T_s$. In such cases, and also when the master gears are refinished, the tip circle diameter must be evaluated in conformity with the mean tooth thickness allowance A_{sm} and finished to this size. The following equation is applicable:

$$d_a = d + 2\, m_n\, (1 + x) + A_{sm} {\cdot} \cos \beta {\cdot} \cot \alpha_n$$

Selection of master gear blank size for non-standard normal module m_n.

Normal Module	*Over*	0·45	1·12	2·24	3·55	5·6	8
	Up to	1·12	2·24	3·55	5·6	8	12
Master gear blank size number		1	2	3	4	5	6

EXPLANATORY NOTE

This standard was originally published in 1967. The standard is being revised to incorporate the experience gained by the Indian Gear Industry in the last 15 years.

Master gears are gears made with sufficient accuracy, capable of being used as the basis for comparing the accuracy of other gears. These are mostly used in composite errors determination in which the master gears are rotated in double flank or single flank contact with the gears under test.

Explanations on the contents of revised standard are given below:

1. *Tooth System* — For reasons of type limitation, master gears with normal module m_n up to 4·25 mm are given uncorrected tooth systems whilst master gears with normal module m_n above 4·25 mm have profile displacement.

   This provision regarding profile displacement ensures in the majority of cases that the root circle as measured by radius, lies not more than 0·25 m_n below the base circle, a tool addendum of 1·25 m_n being taken as the basis for determining the root circle radius. The profile region in the vicinity of the base circle is thereby avoided. This profile is difficult to manufacture and is subjected to heavy wear when it takes part in engaging with the mating gear. By modifying the addendum of the master gear it is possible in the great majority of cases to check the whole of the active profile of the gear so that it is usually unnecessary to use a profile displaced V-tooth system with differing amounts of displacement.

2. *Number of Teeth* — Only even number of teeth are specified. This is to simplify measurement of the tip circle diameter and to reduce the number of index plates required.

3. *Calculation of the Number of Teeth and Profile Displacement Factor* — First, without allowing for any profile displacement, the maximum possible number of teeth z'_{max} for a straight tooth system is calculated from the gear blank diameter corresponding to the required normal module m_n, and the normal module m_n. Thus

$$z'_{max} = \frac{d_B - 2\,m_n}{m_n}$$

   The maximum possible number of teeth z'_{max} obtained from the above is usually not an integer. Depending on whether it is smaller or larger than 60, it is rounded off to the next smaller whole number divisible by 2 or 4 to give z_{max}.

   If the number of teeth z_{max} evaluated in this way is equal to or greater than 35, no profile displacement is necessary. If z_{max} is smaller than 35, the profile displacement factor is calculated as follows:

$$x = 1{\cdot}05 - 0{\cdot}03\,z_{max}$$

   Excepted from this rule are modules up to and including 4·25 which are generally left without profile displacement.

   As a check using the factor x the new value z''_{max} is calculated as follows:

$$z''_{max} = \frac{d_B - 2m_n\,(1+x)}{m_n}$$

   If z''_{max} is smaller than the value z_{max} calculated above, then z''_{max} shall again be rounded off to the next smaller number z_{max} completely divsible by 2 or 4.

   The calculation of x and check for z''_{max} shall then be repeated using the new value of z_{max}.

4. *Helix Angle*—The maxmum helix angle is calculated for the number of teeth z concerned by using the equation

$$\cos \beta'_{max} = \frac{z.m_n}{d_B - 2m_n\,(1+x)}$$

5. *Addendum* h_a, *Active Profile and the Tip Circle Diameter* d_a — The addendum h_a, the active profile and the tip circle diameter d_a of the master gear shall be so chosen and the tooth flanks so finished that the active profile of the gear is tested. This generally results in a tip circle diameter d_a differing from unmodified zero or profile corrected tooth systems.

If no special arrangement is made the addendum of the master gear shall be made to correspond to IS : 2535-1978, i. e.

$$d_a = d + 2m_n (1 + x)$$

where $x=0$ for normal modules up to 4·25 and is to be chosen according to Table 2 or Table 9 for normal modules above 4·25.

In this case, the tooth flanks of fhe master gear are to be so profiled as to ensure trouble free engagement with a basic rack which has been given an addendum of 1·1 m_n to allow for the proportion of flank clearance provided by the gear. The shortest line of action g yielded by this evaluated by using the following equation:

$$g = \frac{1}{2}\sqrt{d_a^2 - d_b^2} - \frac{1}{2} d \sin \alpha_t + m_n \frac{(1 \cdot 1 - x)}{\sin \alpha_t}$$

6. *Tooth Thickness, s* — The tooth thickness of a master gear must lie within the tooth thickness tolerance T_s corresponding to the appropriate grade of tolerance.

The position of the tooth thickness of a master gear must lie within the tooth thickness tolerance T_s correspoding to the appropriate grade of tolerance.

The position of the tooth thickness tolerance zone has no effect on the quality of the master gear. This means that (subject to observance of the size of the tooth thickness tolerance T_s) the tolerance zone may lie anywhere between the limits set by the upper tooth thickness allowance A_{se} and the lower tooth thickness allowance A_{si}. For a new master gear $A_{se} = + T_s$ and $A_{si} = - T_s$ unless otherwise agreed upon.

In preparation of this standard considerable assistance has been derived from the following publications:

1) George W. Michalec : Precision Gearing : Theory and Practice, John Wiley & Sons, Inc., New York, London, Sydney

2) BS 3696 : Part 1: 1977 : Specification for Master Gears : Part 1 Spur and Helical Gears (Metric Module), issued by the British Standards Institution

3) DIN 3970 : Part 1: 1974 : Master Gears for Checking Spur Gears : Gear Blank and Tooth System, issued by Deutsches für Normung.

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